Survey in Classical Database and Quantum database With Logical Design To Memory Management , File Structure and Authentication Module For Quantum Database

SAYANTAN CHAKRABORTY[1,a] ,

[1]Masters In Computer Application from PAILAN COLLAGE OF MANAGEMENT AND TECHNOLOGY , Founder OF NDEDGE INFORMATICS PVT LTD, lp.110/36/3 Manikpur,Manashbhumi Po.Italgacha kolkata 700079

2

3

[a]c.sayan2016@gmail.com, ,

Keywords: QPU quantum processing unit, QKD quantum key distribution, entangle , teleportation, quantum dot, nv (nitrogen vacancy) center qbit, qbit RECO Recovery Process, CKPT checkpointing,DBRW database writer process, himeltonian, OpenQL,QASAM,pyquil,datafiles where data is stored in a file in binary format,SQL Structured Query Language, QVM Quantum Virtual Machine, RDBMS Relational Database Management System OQFile Oracle Generated quantum file which will be retrived by QASAM,QFile will be considered as QASAM generated instractions stored in a logical location in a quantum storage, software stack.

Abstract. This is a survey for the comparison between existing model which is used in classical database and quantum computing. *Theoretically it is possible to converge both of this quantum database in classical database as we will always have Hamiltonian of the signal which are written in binary.Quantum computing holds immense amount of capabilities to solve any classical problems those are unresolved.This report mostly identifies the gap between these classical database and quantum database but it shows no result rather it proposes only the hypothesis of existing mechanism / architecture with new perspective.*

Introduction

Quantum computing mostly developed theoritically with few well known components QKD(quantum key Distribution)[7] tum dot, spin qubit, nv center qubit. Within the Quantum Search Algorithm the quantum oracle is considered as a black-box which has only one operation to perform i.e..improving the performance of searching operations. So in simpler term if we need to break the RSA[11] algorithm with a key and we need to search for the key within this system the quantum oracle will be considered as a black-box which would help the searching process faster. *nitrogen vacancy center* is also used in many cases of quantum cryptography.

In case of quantum accelerator as shown in Fig. 1, it is quite natural to have OpenQL as human like language and QASAM as low level language. The block design of the quantum accelerator is used as follows. Quantum cercitery consists of qubit gates and circuits and qbit can be controlled by superimposition state and coupled together to control entanglement. Qbits can be also optimized any many different ways as they can overlap with qbits' state. Qubits can also have magnatic interaction which may also reduce qubits sophistication. QASAM in Fig. 1, is used as assembly languages for Quantum accelators[13].

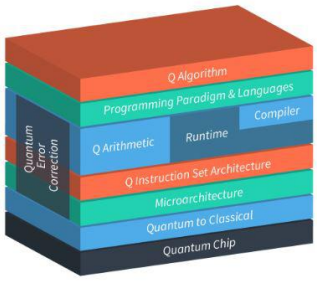

Fig. 1: Quantum Computers' Block Design

d-slit 'A newly proposed quantum computer was proposed in2008 and duality computer, or the duality quantum computer and the duality mode of quantum computers. The duality computer is based on the particle-wave duality principle of quantum mechanics. Compared to an ordinary quantum computer, the duality quantum computer is a quantum computer on the move and passing through a multi-slit. It offers more computing operations than is possible with an ordinary quantum computer. The most two distinct operations are: the quantum division operation and the quantum combiner operation. The division operation divides the wave function of a quantum computer into many attenuated, and identical parts. The combiner operation combines the wave functions in different parts into a single part. The duality mode is a way in which a quantum computer with some extra qubit resource simulates a duality computer. The main structure of duality quantum computers and duality mode, the duality mode, their mathematical description and algorithm designs are reviewed. [3]

Classical Database However within the database we may compress the data or may not,as searching and shorting operation of data can be time consuming due to compression and decompression of data. Now in the case of quantum databases we can only use logical memory management to propose a design which is already in use with mathematical explanations for quantum databases in dual computers.

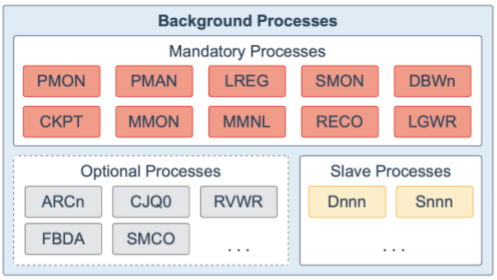

Fig. 2: Background Process [1]

There are few background process which are part of the any robust database[1] eg. oracle , DB2[2] i.e.. CKPT(checkpointing), RECO(Recovery process), DBRWn(it writes data into datafiles),LGWR(writes redo logs) etc. as described in the images. In fact the current version of oracle also introduced many more features which is containerization. But CKPT is responsible for creating Checkpoint.We will take a glance at the CKPT process now. CKPT process is actually responsible for updating the headers for many datafiles. just like Fig. 2, and Fig. 3,

1. As changes are made to the database, they are quickly recorded in the redo log.

2. We have three redo log entries. They are all shown in blue, because DBRW has not yet written any of the changes to the datafiles.

3. The database writer will write out some changes. Here, the changes for entries 1 and 2 have been written to the datafiles.

4. A checkpoint is recorded every three seconds. Here the checkpoint is redo log entry 3, because all prior changes have been written.

5. This process continues. More redo records are written

6. More changes are written to the datafiles.

7. and finally the checkpoint is advanced.

8. Similerly we can put all other processes and components within the quantum database to enhance the performance of databases' searching and shorting mechanism.

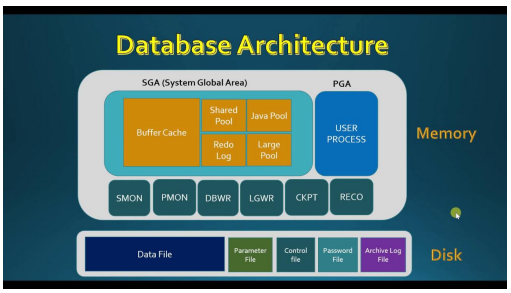

Fig. 3: Database Architecture [1]

Method

This reaserch is a survey report and this survey is conducted based on the past research work and RDMS which explores the gap between theoritical research developed by quantum computing and currently deployed RDMS eg. Oracle and DB2.It also proposes a logical mechanism of memory management , authentication module as the way title is suggested.

The decison is made for this report based on the past reserch and related work.

Problem definition or hypothesis

As it is quite trivial to derive quantum database model from d-slit quantum computer we can easily establish the above mentioned model eg.

hypothesis 1. Memory management for quantum database ; it can be solved by hybrid model eg. We can simply use existing part in classical computer and some part of it eg. searching we can use QPU. But most efficient will be using the QPU using d-slit quantum computer.

hypothesis2. In[14] it is mentioned a security enhancement for classical database we can easily modify the process in terms of d-slit quantum database as mentioned in Fig 5..

Quantum Memory Management before we begin to propose an alternative improvement with the existing architechture I would like to introduce a term eg.QPROC which will denote Quntum process that will either retrive any instruction form QPU or generate a QASAM instructions. In this Fig 4 it is clear we will keep all the process as it was before but we will introduce a new process that will deal with the average of the histogram which will be generated from QPU of the quantum accelerator we mentioned it QHist Reader. and QCKPT the quantum databases' checkpointing process will be there to generate the checkpointing within quantum database.

Quantum Files in Quantum Storage In this Fig 4 it is explained clearly that we can easily store necessary quantum files in quantum storages as it will be basically few storage qubit(mentioned in [inst15] and we can easily add few more qubit to store them in dual quantum computer(d-slit) also.

Along with the mentioned files which was there in classical computer we will store other information of previously executed queries and previously processes' histogram also into quantum storage which can be accessed for future references. In case of storing data it is quite natural we will consider a quantum storage, and quantum storage can be two types 1. the quantum accelarator which will have complete detabase will consists a quantum storage or it will be anoter accelarator which will have quantum storage and it will be attached with a classical computer . This classical computer will be responsible to generate instructions through qx[13] , Pyquil[10] through quantum algorithms in first cases. But in second cases quantum to classical layer Fig 1 will communicate the other quantum storages to retrive the data. As it is mentioned in [15] we can even have a shared memory in quantum hybrid computer and similer qubit can be used for dual quantum computer[15] also.

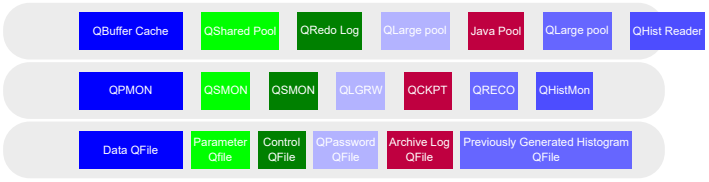

Fig. 4: Logical Databases' File Structure And Memory Management [1]

The enhancement in module For Authentication Will Look Like:

If we consider database security only (As proposed in [14]) the Authentication module for either of any RDBMS,can be kept in this quantum accelerator and then we can allow authenticated clients to execute SQL statement after receiving the quantum signal from the quantum network .

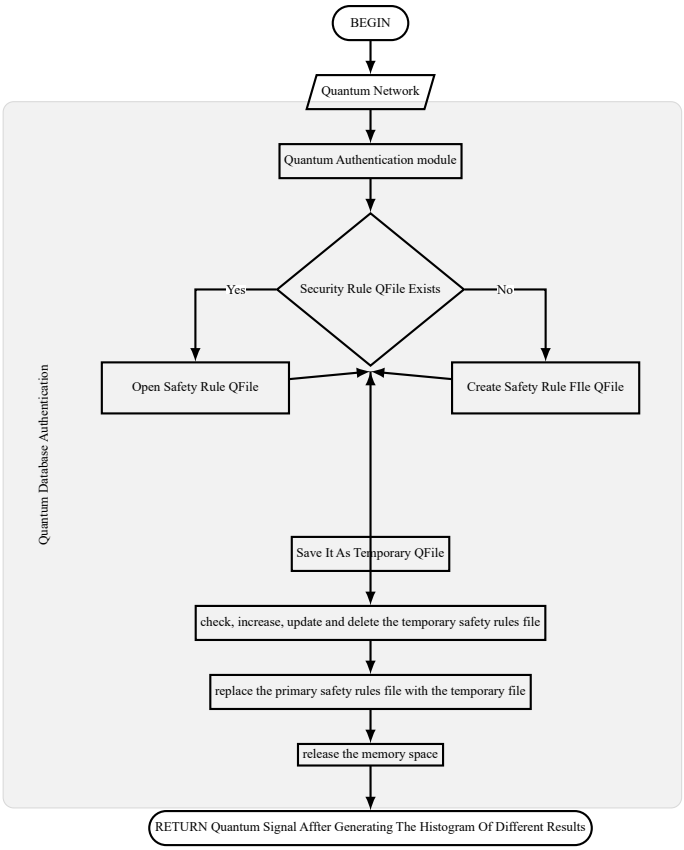

Fig. 5: Enhancement Module Architecture [14]

This will finally return a Quantum Signal from the histogram generated by the QPU finally to clients that the users is authenticated or not. To simulate this mechanism with PyQuil you can easily define a QVM based this authentication mechanism and simulate such scenario. This process most likely works in classical computer which is mentioned in [14] but in this case we will store these files in QASAM formats which will be retrieved only by same QASAM compiler. As each and every Quantum Computer/accelerator will be an analogue devices so we can our case we will consider it as OQASAM (Oracle QASAM)or DBQASAM(for generic database) as this QASAM will be different for different purpose.Each and Every files generated by OQASAM we will consider it as OQFile.So the most possible authentication mechanism would be as mentioned in Fig 5 However in this case whole authentication module will be redesigned with quantum cryptography[16] as QPU will have more computing efficency than classical computer.As it is mentioned in [15] We can easily connect from one instance to another eg. intercommunication between different node is possible with NetQASAM.

Summery And Future Work:

This Report has a limitation of existing work to find the gap between theoritical quantum database and modern RDBMS but QASAM is not within the scope as those robust RDBMs' sources are not within our reach.As we can see with this comparison report that there is some gap between the classical database and currently developed quantum database we can meet this gap using quantum computing: **hypothesis** 1. Storing data in a quantum database and duality of quantum computer which will include features like automatic storage management which will also consider the redundancy during storing the data.

hypothesis 2. Automatic indexing[1] which will minimize the workload of searching operations.

hypothesis 3. there is quite a few way we can convert any existing classical computers' problem in the quantum computers ie. Hamiltonian.

hypothesis 4. To ensure more security in terms of database we can easily deploy authentication mechanism of database or any federation within a hybrid quantum computer (or quantum accelerator) which will be responsible for user authentication.

hypothesis 5. As it is noticed the searching and shorting operations happen also within disks (if it is not any in-memory database), which is considered as disk shorting , we may consider storing data in quantum storage which will also ensure redundancy of data.

Acknowledgments

I am the solo author for this report and it was prepared as a report for my future doctoral program.I am grateful to all the resercher who worked earler in their own articles used for references.

Competing interests

This journal is not a part of any affialtion and funding so it holds no Competing interests for financial and non-financial purposes.

References

[1] 1. Oracle database architecture from oracle database documentations https://docs.oracle.com/en/database/oracle/oracle-database/index.html

[2] 2. DB2 database architecture based on db2 documentation provided by IBM https://www.ibm.com/docs/en/db2-for-zos/12?topic=SSEPEK_12.0.0/home/src/tpc/db2z_pdfmanuals.html

[3] Y. Mishing, in: *Diffusion Processes in Advanced Technological Materials*, edtied by D. Gupta Noyes Publications/William Andrew Publising, CityplaceNorwich, StateNY (2004), in press.

[4] 4. Duality quantum computing Guilu LONG (*), Yang LIU https://link.springer.com/article/10.1007/s11704-008-0021-z

[5] 5. Deleting a marked state in quantum database in a duality computing Mode LIU Yang1,2

[6] 6. Quantum Database Searching by a Single Query Dong Pyo Chi □† and Jinsoo Kim □‡ 15 July 1997

[7] 7. Quantum Computing The transformative Technology of the Qubit Revolution - Brain Clegg

[8] 8. Quantum computing with trapped ions H. H¨affner a,b,c,d C. F. Roos a,b R. Blatt a,b a Institut f¨ur Quantenoptik und Quanteninformation, Osterreichische Akademie ¨ der Wissenschaften, Technikerstraße 21a, A-6020 Innsbruck, Austria b Institut f¨ur Experimentalphysik, Universit¨at Innsbruck, Technikerstraße 25, A-6020 Innsbruck, Austria cDept. of Physics, University of California, Berkeley, CA 94720, USA dMaterials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA https://arxiv.org/pdf/1705.04103.pdf

[9] 9. NMR Techniques for Quantum Control and Computation Lieven M.K. Vandersypen □ Kavli Institute of NanoScience, Delft University of Technology, Lorentzweg 1, 2628 CJ Delft, The Netherlands Isaac L. Chuang † Center for Bits and Atoms Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA https://arxiv.org/pdf/quant-ph/0404064.pdf

[10] Information https://pyquil-docs.rigetti.com/en/stable/start.html

[11] Information https://en.wikipedia.org/wiki/RSA_(cryptosystem)

[12] Information https://research.ibm.com/blog/near-real-time-quantum-compute

[13] Information https://www.qutube.nl/quantum-computer-12/the-building-blocks-of-a-quantum-com

[14] Design and Implementation of Security Enhanced Module in Database Peng Wang , Liu Xing2 , Xin Gu1, Changming Zhu11 Research and Development Center, China Academy of Launch Vehicle Technology, Beijing, China 100076 2 Beijing Aerospace Long March Scientific and Technical Information Institute, Beijing, China 100076 wpf1998@sohu.com; xingliu2009@126.com; wangdannina@163.com;zhuchangming2003@126.com DOI: 10.1109/ICICIS.2010.5534685

[15] Information NetQASM—a low-level instruction set architecture for hybrid quantum–classical programs in a quantum internet Axel Dahlberg1,2,3 , Bart van der Vecht1,2,3, , Carlo Delle Donne1,2 , Matthew Skrzypczyk1,2, Ingmar te Raa1,2 , Wojciech Kozlowski1,2 and Stephanie Wehner1,2, 1 QuTech, Lorentzweg 1, 2628 CJ Delft, The Netherlands 2 Kavli Institute of Nanoscience, Delft, The Netherlands Authors to whom any correspondence should be addressed. 3 These authors contributed equally. E-mail: b.vandervecht@tudelft.nl and s.d.c.wehner@tudelft.nl

[16] Information: Device-independent two-party cryptography secure against sequential attacks Jędrzej Kaniewski1,2 and StephanieWehner2 1 Centre for Quantum Technologies, National University of Singapore, 3 Science Drive 2, Singapore 117543 2 QuTech, Delft University of Technology, Lorentzweg 1, 2628 CJ Delft, The Netherlands